OWNER'S MANUAL

Cat. No. 22-220

FET ANALOG MULTITESTER

PLEASE READ BEFORE USING THIS EQUIPMENT

MICRONTA®

FEATURES

This high sensitivity MICRONTA FET Analog Multitester is designed to measure up to 1000 volts (AC/DC), 10 amps (DC) and 100 megohms resistance with accuracy and ease. It also can measure down to 20 millivolts (DC) and a few microamps (DC).

The dual FET circuit, protected by a fuse, provides high input impedance with circuit stability that rivals the finest VTVMs. The 9-volt battery for the FET circuit is easily checked by the BATT CHECK switch on the front panel.

A special audible continuity check function is incorporated. The built-in buzzer will sound when the circuit continuity is approximately 300 ohms or less.

The dB function for audio measurement provides great versatility at low AC signal levels.

The large 5″ (12 cm) color-coded meter face and **mirrored scale** make accurate reading a simple matter.

The single-knob range/function control is easy to use and read.

The handle also supports the meter at an easy-to-read angle.

These features combined with rugged design and quality parts ensure you of many years of accurate measurements.

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Caution: Permanent damage can occur to your FET Analog Multitester from exceeding the specified limits or attempting to make measurements with the range selector in wrong position.

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SPECIFICATIONS

Ranges:	22
DC Voltage:	0-1-3-10-30-100-300-1000 V
AC Voltage:	0-3-30-100-300-1000 V
DC Current:	0-100 μA-1-30-300 mA-10 A
Resistance:	0-1K-10K-1M-10M-100 Mohms (center scale 10)
Buzzer Continuity:	0—300 ohms (approx.)
Decibels:	−20 to +62 dB in 5 ranges

Accuracy	
DC Voltage:	±3% of full scale value
AC Voltage:	±4% of full scale value
Frequency Response:	
45 Hz to 1 kHz:	± 1 % up to 30 V
1 kHz to 10 kHz:	± 3 % up to 30 V
DC Current:	±3 % of full scale value
Resistance:	±3 % of full scale length

Sensitivity	
DC Voltage:	10 Mohms (32 Mohms for 1000 V range)
AC Voltage:	10 kohms/volt
DC Current:	316 mv
Meter Movement:	5″ (12 cm), 3-color, mirrored scale, 50 μA full scale
Batteries:	Requires one C-type and one 9-volt battery
Test Leads:	Banana plug style (Cat. No. 278-704)
Fuse:	0.5 A 250 V (Cat. No.270-1271)
Dimensions: (H x W x D)	7-1/8″ x 5-1/2″ x 2-13/16″ (180 × 140 × 71 mm)
Weight:	1lb 11oz (780g)

CONTROLS AND FUNCTIONS

1. **Handle**
   Flip to the back to support the meter at an easy-to-read angle. Or use to carry your tester.

2. **Scale**
   For ACV, DCV, OHMS, DCA and dB readings. Look at the scale from the point where the pointer and its reflection on the mirror come together.

3. **Zero Adjust Screw**
   Use to rest the pointer exactly over "0" at the left side of the AC/DC scale when the FET Multitester is OFF.

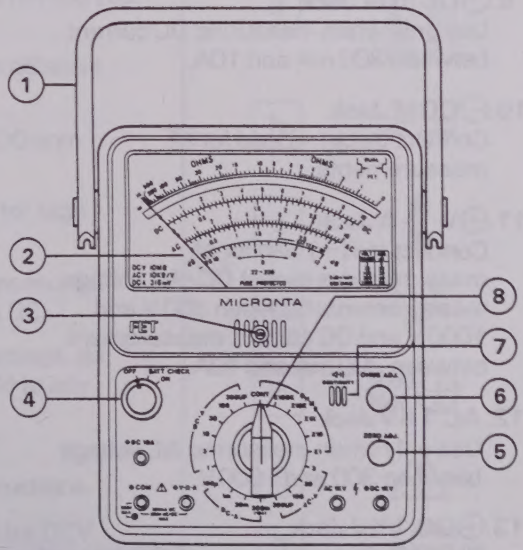
4. **Power ON/OFF and BATTery CHECK Switch**
   Use to turn the FET Multitester on and off. Set to the BATT CHECK position to check the 9-volt battery condition. Leave it OFF when the tester is not in use.

5. **ZERO ADJ. Control**
   Use to balance the internal circuitry to obtain "0" reading when the FET Multitester is ON.

6. **OHMS ADJ. Control**
   Use this control to set the meter reading to "0" on the OHMS scale when measuring resistance (with tester probes connected together).

7. CONTINUITY Buzzer
Sounds when the resistance of the circuit under test is approximately 300 ohms or less.

8. Range Selector
Use to select the desired test range and test type.



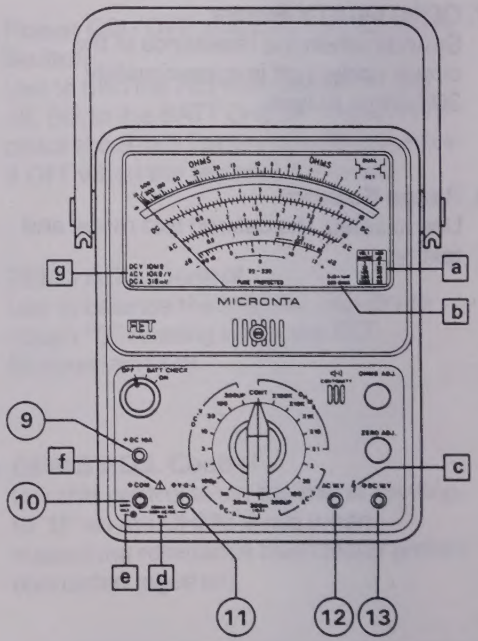
9.⊕DC 10A Jack
Use only when measuring DC current between 300 mA and 10A.

10.⊖COM Jack
Connect black (−) lead for all measurements.

11.⊕V·Ω·A Jack
Connect red (+) lead for all measurements except DC/AC voltage measurements between 300 V and 1000 V and DC current measurement between 300 mA and 10A.

12. AC 1 KV Jack
Use only when measuring AC voltage between 300 and 1000 V.

13.⊕DC 1 KV Jack
Use only when measuring DC voltage of 300 to 1000 V.



Explanation of Special Panel Markings

Special markings have been added to the panel to remind you of safety.

a. Add the appropriate number in this chart to the dB scale reading. See "DECIBEL MEASUREMENTS."

b. 0 dB means that 1 milliwatt is dissipated in a 600 ohm impedance.

c. Be extra careful when making measurements for high voltage; do not touch terminals or probe ends.

d. The maximum voltage or current that can be measured between these jacks is 300 V AC/DC, 300 mA DC.

e. To avoid electrical shock and/or instrument damage, do not connect the common input terminal (— jack) to any source of more than 500 volts with respect to earth/ground.

f. Refer to the following complete operating instructions.

g. The inner resistance of this tester is 10 Mohm for DCV, 10 kohm per volt for ACV and the sensitivity for DCA is 316 mV.

a

VOLT RANGE	ADD dB
3	0
30	20
100	30
300	40
1000	50

b

0 dB = 1 mW
600 OHMS

c

d

300mA DC
300V AC/DC
MAX

e

500V MAX

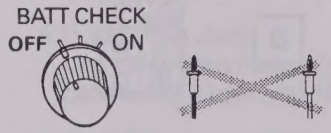
f

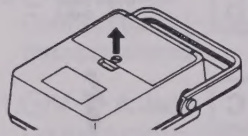
g

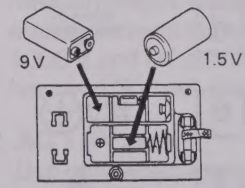
DCV 10MΩ
ACV 10KΩ/V
DCA 316mV

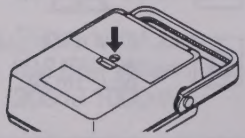
SETTING UP YOUR TESTER

Battery Installation









You will need to install one 9-volt battery for the dual FET circuitry, and one 1.5 V C battery for the resistance function. We recommend our 23-583/553 for 9 V, 23-581/551 for C.

1. Be sure that the test leads are disconnected. The power ON/OFF/BATT CHECK switch should be OFF.

2. Open the cabinet by loosening the screw from the back.

3. Install the batteries in the correct compartments. Observe proper polarity.

4. Close the cabinet and tighten the screw.

Remember: Never leave weak or dead batteries in your unit. Even "leak-proof" ones may leak damaging chemicals. Also, if you are not going to use your unit for a week or more, remove the batteries.

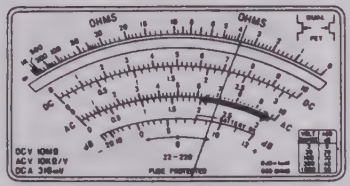
Checking the 9 V Battery

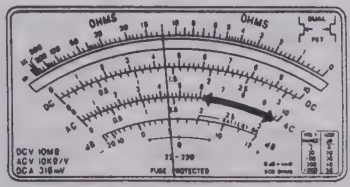
Check the 9 V battery for the first time it is installed and periodically after then to assure accurate measurements .

1. Set the power ON/OFF/BATT CHECK switch to BATT CHECK and watch the scale.

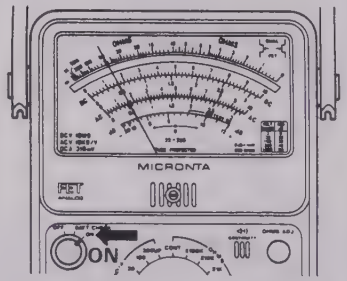
2. If the pointer rests in the range specified as BATTERY OK, the 9 V battery is OK.

3. If the pointer does not rest in the BATTERY OK range, replace the 9 V battery.

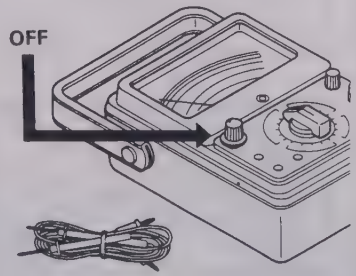




Switching Power to the FET Multitester



Be sure to set the power ON/OFF switch to ON before using your tester.



When not in use, or when carrying the tester, leave the ON/OFF switch to OFF.

Zero Adjustments

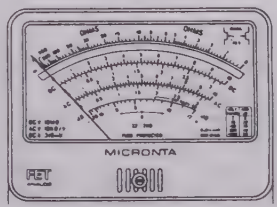
Before using your tester, adjust the pointer so that it rests exactly over 0 at the left side of the scale.

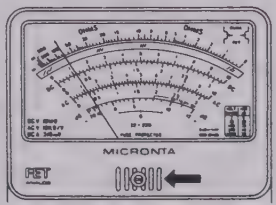
Mechanical Zero Adjustment

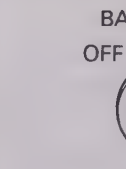
1. Set the power ON/OFF/BATT CHECK switch to OFF.

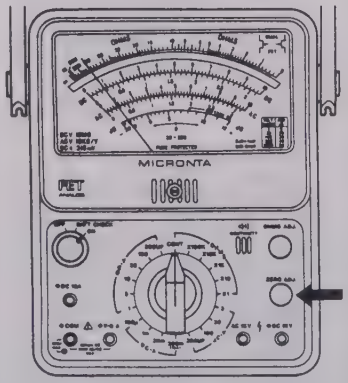
2. Check to see if the pointer rests exactly over "0" at the left side of the scale.

3. If it does not, adjust the plastic screw below the scale to bring the pointer to "0".









Electrical Zero Adjustment

1. Complete the mechanical zero adjustment as above.
2. Set the power ON/OFF/BATT CHECK switch to ON.
3. Check to see if the pointer rests over "0" at the left side of the scale.
4. If it does not, adjust the ZERO ADJ. control at the lower right side of the Tester to bring the pointer to "0".

Using Test Leads

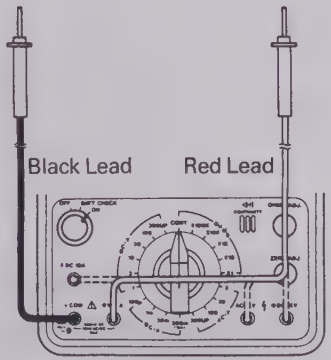
Use only the same type of test leads as are supplied with your unit. These test leads are rated for 1200 volts; replacements are available from your local Radio Shack store. (Cat. No. 278-704)

CAUTION: Although these test leads (Cat.No.278-704) are rated for 1200 V, the maximum rating of this tester is 1000 V. You should not attempt to measure any voltage greater than 1000 V.

Always observe correct test lead polarity when making measurements: The black lead should always be connected to the ⊖COM jack. Connect the red lead to ⊕V·Ω·A for making DC/AC voltage measurements below 300V, DC current below 300mA, and all resistance measurements; connect it to ⊕ DC 1 KV when measuring DC voltage from 300 V to 1000 V; connect it to AC 1 KV when measuring AC voltages from 300 V to 1000 V; and connect it to ⊕ DC 10A when measuring DC current from 300 mA to 10A.

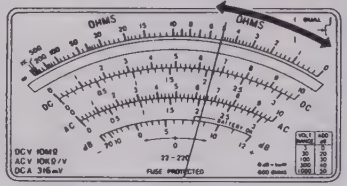
NEVER ALLOW YOUR FINGERS TO TOUCH THE BARE METAL PART OF THE TEST PROBES (OR CIRCUIT POINTS).

For safety's sake, disconnect the leads from the circuit under test as soon as you have completed measurements.



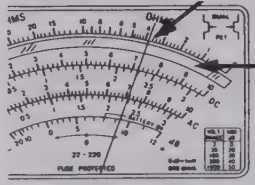
Meter Reading

The upper 1/3rd



For most accurate readings, keep the tester lying flat on a non-metallic surface. Also, use a range selector setting that results in a reading in the upper 1/3rd of the meter scale.

Pointer

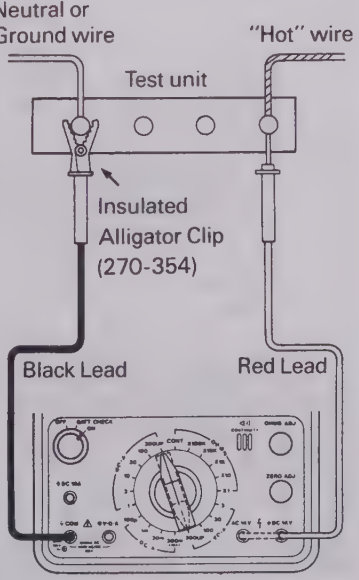


Mirror

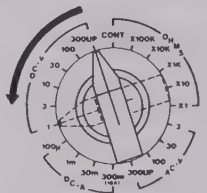
To read the scale, look at it from the point where the pointer and its reflection on the mirror come together; a different angle will cause an error in the reading.

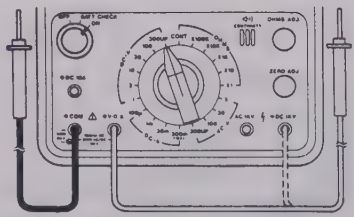
Using Alligator Clip

When you use the tester to probe for a voltage in a high voltage circuit, we recommend that you do not try to position both of the probes at once. Instead, you should clamp one of the leads to the neutral or ground lead of the circuit (usually a bare, green or white lead in AC wiring circuit) using our Insulated Slip-On Alligator Clips (Cat. No. 270-354), and then probe for voltages with the other probe. This helps to prevent you from accidentally touching a "hot" wire, since you need only concentrate on one test probe. Never clamp on to a "hot" wire, (usually red, black or blue in AC wiring circuit); if you did so and then touched the other probe connected to the tester, you could receive an electric shock.



DC Voltage Measurements





WARNING: USE EXTREME CARE WHEN MAKING HIGH VOLTAGE MEASUREMENTS; DO NOT TOUCH TERMINAL OR PROBE ENDS.

1. Set the range selector to one of the DCV range.

If you are uncertain about the level of voltage, start with the highest range.

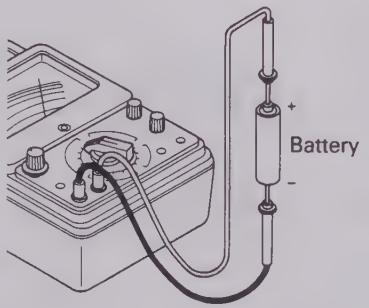
Note: The 300UP position can be used for voltages between 100 and 300 volts when you plug the red lead into ⊕ V·Ω·A jack; if you plug the lead into ⊕ DC 1 KV jack, the 300UP position will become for voltages between 300 and 1000 volts.

2. Plug the red lead into the correct jack; ⊕DC 1KV jack for voltages between 300 and 1000 volts; ⊕V·Ω·A jack for voltages below 300 V.

Note: The ⊕DC 1 KV jack is only for use with DC voltages of 300 to 1000 V. USE EXTREME CARE WHEN USING THE HIGH-VOLTAGE RANGE.

3. Plug the black lead into ⊖COM.

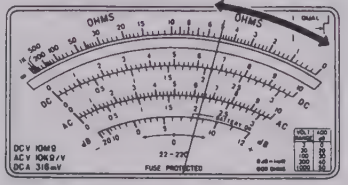
4. Connect the test probe tips to the circuit under test; be sure to observe correct polarity.



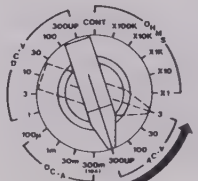
5. Set the range as required to obtain a meter reading in the upper 1/3rd of the meter scale.

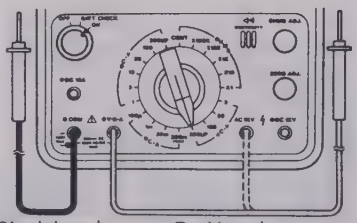
6. Read the voltage on the black DC scales.

The upper 1/3rd



AC Voltage Measurements





Black Lead Red Lead

WARNING: USE EXTREME CARE WHEN MAKING HIGH VOLTAGE MEASUREMENTS; DO NOT TOUCH TERMINAL OR PROBE ENDS.

1. Set the range selector to one of the ACV range.

If you are uncertain about the level of the voltage, start with the highest range.

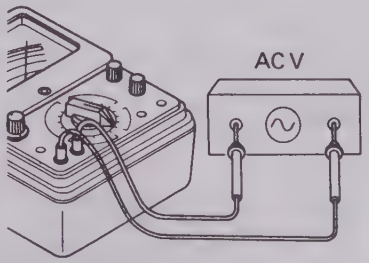
Note: The 300UP position can be used for voltages between 100 and 300 volts when you plug the red lead into ⊕ V·Ω·A jack; if you plug the lead into AC 1 KV jack, the 300UP position will become for voltages between 300 and 1000 volts.

2. Plug the red lead into the correct jack; AC 1 KV jack for the voltages between 300 V and 1000 V; ⊕ V·Ω·A jack for the voltages below 300 V.

Note: The AC 1 KV jack is only for use with AC voltages of 300 V to 1000 Volts. USE EXTREME CARE WHEN USING THIS HIGH VOLTAGE RANGE.

3. Plug the black lead into ⊖ COM.

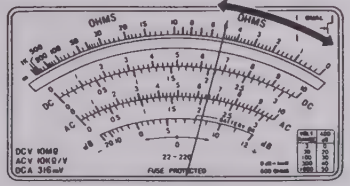
4. Connect the test probe tips to the circuit under test.



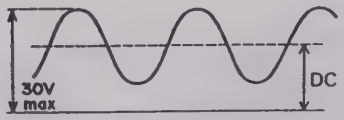
5. Set the range as required to obtain a meter reading in the upper 1/3rd of the meter scale.

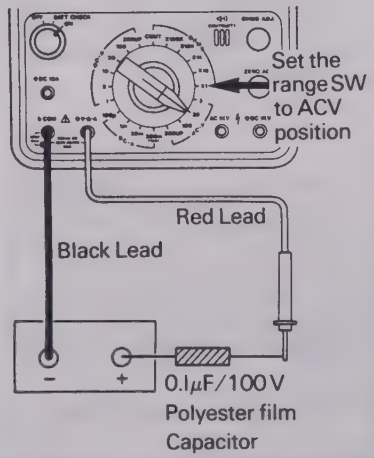
6. Read the voltage on the red AC scale.

The upper 1/3rd



Measuring AC Voltage Riding on a DC Source Bias





Note: When measuring an AC voltage superimposed on a DC voltage source bias, ordinary measurements cannot be made. Under such conditions, if you know the approximate voltage of the device to be measured and the voltage is UNDER 30 V DC/AC, you can measure the voltage by connecting a 0.1μF/100 V polyester film capacitor in series with the positive terminal of the voltage source and the (+) test lead. The range selector is set to ACV.

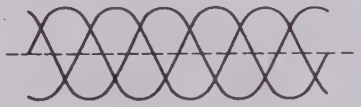
WARNING: NEVER ATTEMPT TO MEASURE OVER 30 V AC ON DC SOURCE BIAS.

Measuring 3-Phase AC Voltages

This tester is designed primarily to measure household AC voltages. When measuring 3-phase circuits line-to-line, the value of the voltage will actually be higher than the rated line-to-ground 3-phase voltage. It is important that you do not exceed the maximum RMS AC rating of this meter, which is 1000 VAC. To determine the RMS voltage line-to-line on a 3-phase line, multiply the rated line-to-ground voltage by the square root of 3 (approx. 1.732).

For example, on a "600-volt 3-phase line" (i.e. 600 V line-to-ground), the total available voltage line-to-line is 600 × 1.732, or approximately 1039 VAC. This exceeds the rating of this tester. Severe damage as well as a dangerous shock hazard could result if the meter were connected to the circuit.

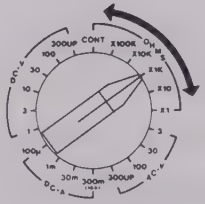
Watch for 3 phase circuits line-to-line.

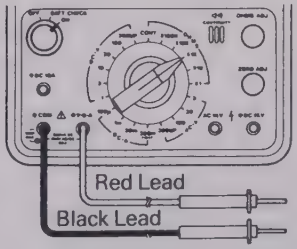


The voltage will be higher.

Remember 1000 VAC is maximum.

Resistance Measurements





WARNING: DO NOT APPLY VOLTAGE TO TEST LEADS WHEN THE RANGE SELECTOR IS IN OHMS POSITION.

BEFORE TAKING ANY RESISTANCE MEASUREMENTS, DISCONNECT POWER TO THE UNIT UNDER TEST AND DISCHARGE THE CAPACITORS. It is best to remove any batteries from the unit under test and unplug line cords.

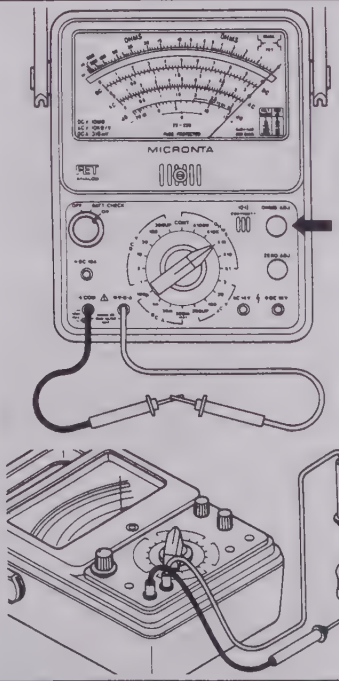
1. Set the range selector to one of the OHMS positions.

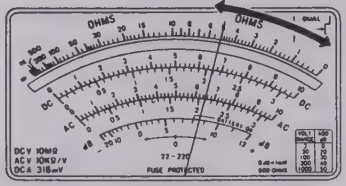
2. Plug the black lead into ⊖COM and the red lead into ⊕V·Ω·A jack.

3. Touch the test probe tips together and adjust the OHMS ADJ. control to bring the pointer to "0" on the top (green) OHMS scale.

Note: When you are unable to adjust the pointer to "0" on the OHMS scale in any OHMS position, replace the 1.5 V C battery.

4. Connect the probe tips across the circuit or parts under test. It is best to disconnect one side of the parts under test, thus the remainder of the circuit will not interface with the reading.





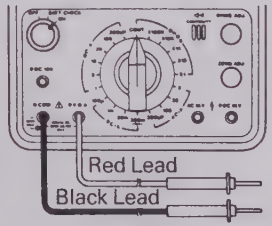
5. Read the resistance on the green OHMS scale. Use the proper multiplier to obtain the correct value (R "times" 1, 10, 1K, 10K or 100K, depending on the position of the range selector).

Note for Testing Semiconductor Junctions: When attempting to identify cathode and anode ends or the type of transistor (PNP or NPN), the actual polarity of the tester's voltage is opposite of the lead colors. The red lead is the negative source. The black lead is positive.

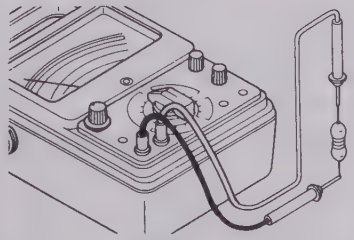
Continuity Check

1. Set the range selector to the CONT position on the OHMS range.

2. Plug the black lead into ⊖COM and the red lead into ⊕V·Ω·A.

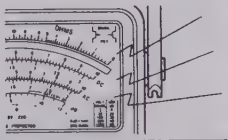


3. Connect the test leads to the unit under test.

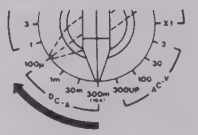


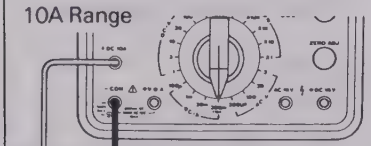
4. If the resistance is 0 to 300 ohms (approx.), the built-in buzzer sounds.

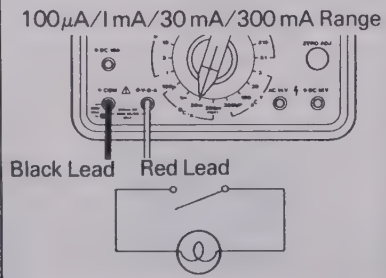
Note: If the buzzer does not sound when you short the test leads, check the 9 V battery by using the BATT CHECK switch. Replace the 9-volt battery if necessary.



DC Current Measurements







To measure current, you must break the circuit and connect the leads in series with the circuit.

WARNING: DO NOT APPLY VOLTAGE TO THE TEST LEADS WHEN THE RANGE SELECTOR IS IN THE CURRENT POSITION (DC.A POSITION).

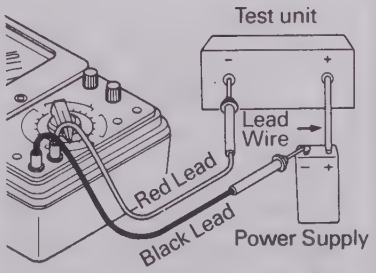
1. Set the range selector to one of the DCA positions. Always start at the highest range and work down.
2. Plug the red lead into the correct jack; ⊕DC 10A jack for current between 300 mA and 10A, ⊕ V·Ω·A jack for current below 300 mA.

Note: The ⊕DC 10A jack is for use only with DC current of 300 mA to 10A.

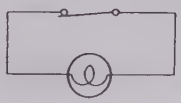
3. Connect the black lead into ⊖COM.

4. Remove power from the circuit under test and then break the circuit at the appropriate point.

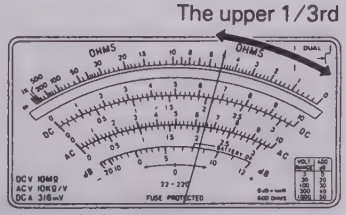
5. Connect probes to the circuit in series (black lead to the negative side and the red lead to the positive side).



6. Apply voltage to the circuit under test.



7. Set the range selector as required to obtain a meter reading in the upper 1/3rd of the scale.

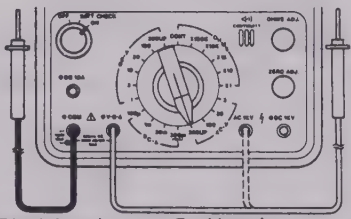


8. Read the current on the black DC scale.

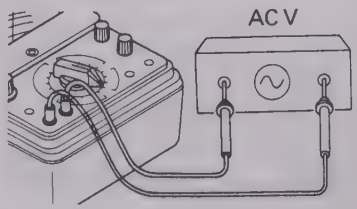
Note: Do not attempt to read AC current.

Decibel Measurements

1. Set the range selector to one of the ACV positions; it is best to start at the highest range and work down.



2. Plug the black lead into ⊖COM and red lead into ⊕ V·Ω·A. Or plug the red lead into AC 1 KV jack with the range selector setting at 300UP.

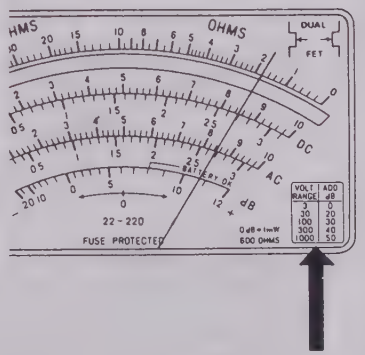


3. Connect the test probe tips to the circuit under test.

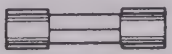
4. Set the range selector as required to obtain a meter reading in the upper 1/3 of the dB scale.

5. Read dB on the dB scale, adding the appropriate number of dB to the dB scale reading as noted on the chart at the lower right on the meter face.

Note: For absolute dB measurements, circuit impedance must be 600 ohms. 0 dB = 1 milliwatt dissipated in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).



REPLACEMENT OF BATTERY/FUSE



0.5 A 250 V
(Cat. No. 270-1271)

WARNING: TO AVOID ELECTRIC SHOCK, DISCONNECT THE TEST LEADS BEFORE REMOVING THE BATTERY OR FUSE. REPLACE ONLY WITH THE SAME TYPE BATTERY OR FUSE. OPEN THE CABINET ONLY WHEN REPLACING THE BATTERY OR FUSE. DO NOT TOUCH ANY AREA INSIDE THE CASE OTHER THAN BATTERY OR FUSE.

CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE, REPLACE ONLY WITH 0.5 A, 250 V FUSE (Cat. No. 270-1271).

Note: The fuse will blow when voltage is applied when the unit is set to measure OHMS or DC.A. When the fuse blows there will be no meter movement and you must replace the fuse.

To install or replace the battery or fuse:

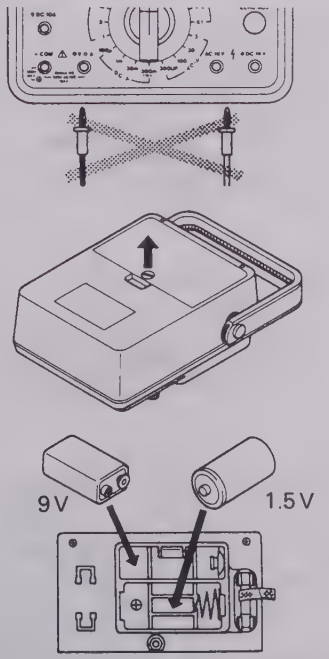
1. Disconnect the test leads.

2. Open the cabinet by loosening a screw on the back.

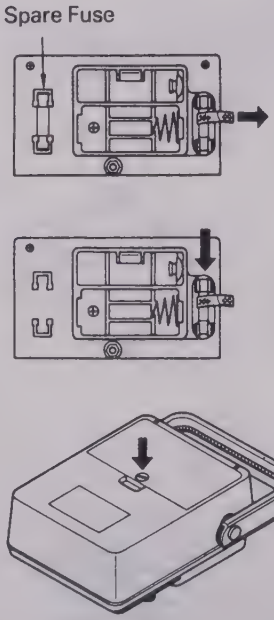
3. Replace the battery if necessary.

   Install one 9 V battery such as our Cat.Nos.23-583/553 and one C 1.5 V battery such as our Cat.Nos.23-581/551. Observe correct polarities.

Replacement of Battery/Fuse



Replacement of Battery/Fuse



4. If the fuse has blown, remove it by pulling the red ribbon in the fuse compartment. The fuse will pop out.

5. Insert a new fuse on the ribbon ring; use only one of the same type/rating (0.5 A, 250 V) such as our Cat.No.270-1271. One spare fuse is supplied with your Multitester inside the cabinet.

6. Close the cabinet and replace the screw.

WARNING: DO NOT OPERATE THE UNIT UNTIL THE CABINET IS FULLY CLOSED.

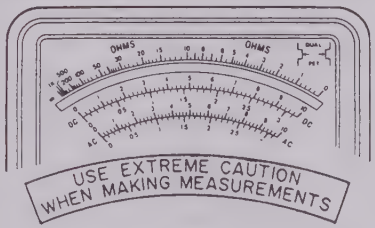
GOOD METER MEASUREMENT PRACTICES

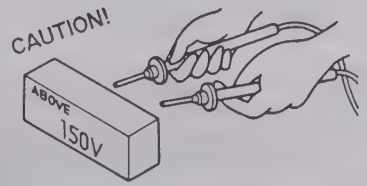
Here are some good general rules that apply to the use of electrical meters. Some are common-sense; others are important safety precautions.

1. CAUTION: There is always the possibility of dangerous voltages being present in any piece of electrical/electronic equipment. Always use extreme caution when making measurements — high voltage may appear at unexpected points in a suspected defective circuit.

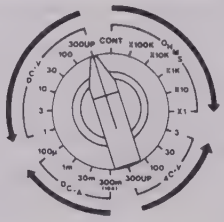
2. Never attempt to measure voltage or current above the specified maximum the Multitester is designed for; the maximum input limit for voltage and current measurement between ⊕ V·Ω·A and ⊖ COM is 300 V AC/DC and 300 mA DC.

3. Exercise extreme caution when measuring voltages of 150 V and above.

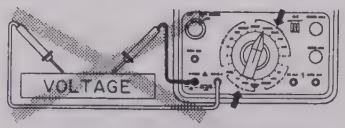




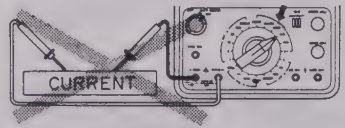
Good Meter Measurement Practices



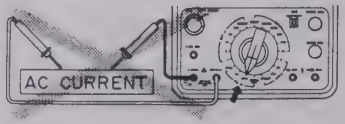
4. When making voltage and current measurements always start with the highest range available.



5. Never attempt to measure a voltage when the function is set to resistance or current. (It may burn out the meter movement or other circuitry.)



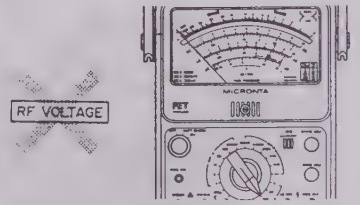
6. Never attempt to measure current with the tester set for resistance.



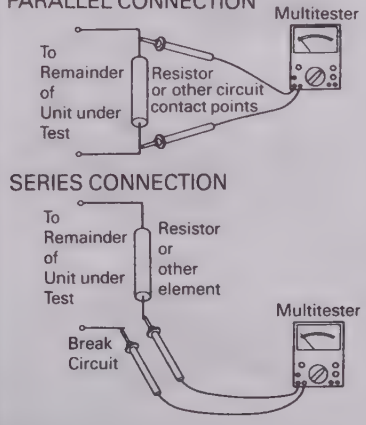
7. Never attempt to measure AC voltages or current with the tester set to a DC mode. (Meter circuitry can be damaged.)

Good Meter Measurement Practices

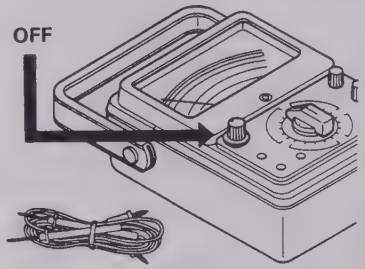
8. Do not attempt to measure RF voltages with the Multitester. (It can be damaged, or, at best, the readings will be meaningless.)



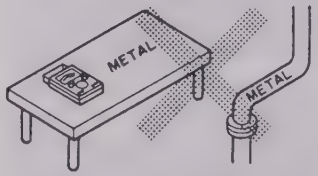
9. Remember that voltage and resistance measurements are made with the Meter connected in parallel. Current measurements are made with the Meter connected in series.



Good Meter Measurement Practices



10. When the Multitester is not in use, always leave the power ON/OFF switch in the OFF position.



11. When making measurements, never stand on a wet or damp floor. Do not work on or even near any grounded metal object — for example, a metal work table, metal water or gas pipes, metal electrical conduit. Accidental contact between the grounded metal object and the circuit under test can be lethal.

12. Get into the habit of keeping one hand in your pocket when troubleshooting any equipment containing high voltage circuitry.

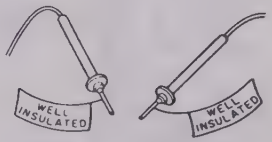
Good Meter Measurement Practices

13. You should remember that even a small shock can be dangerous, because your body's reaction to a minor shock can cause you to bump or fall against a higher voltage contact.

14. Do not expose your meter to moisture; avoid high humidity and excessive dust and dirt.

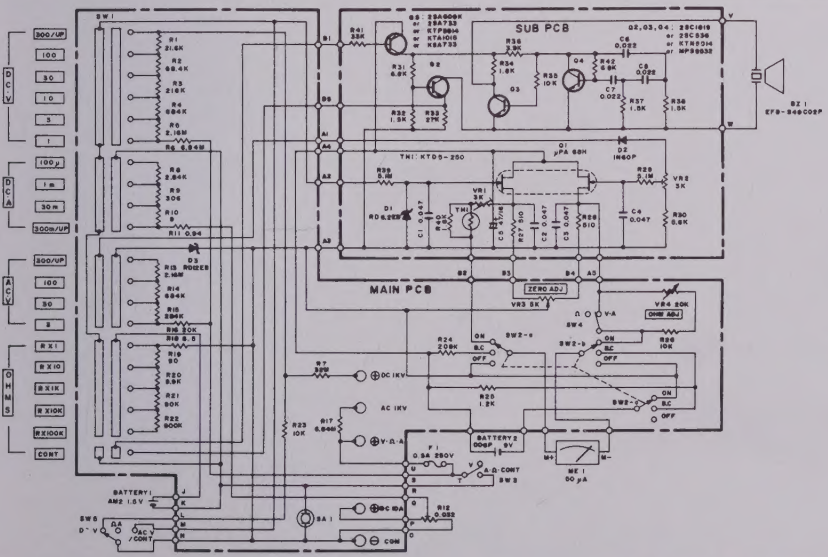
15. Avoid vibration or mechanical shock; the Multitester might be damaged or its accuracy affected.

16. Avoid using meters in locations with high magnetic fields. (Inaccurate measurements can result.)



17. Always use only well insulated test leads. Never use test leads with frayed or broken insulation.

SCHEMATIC DIAGRAM

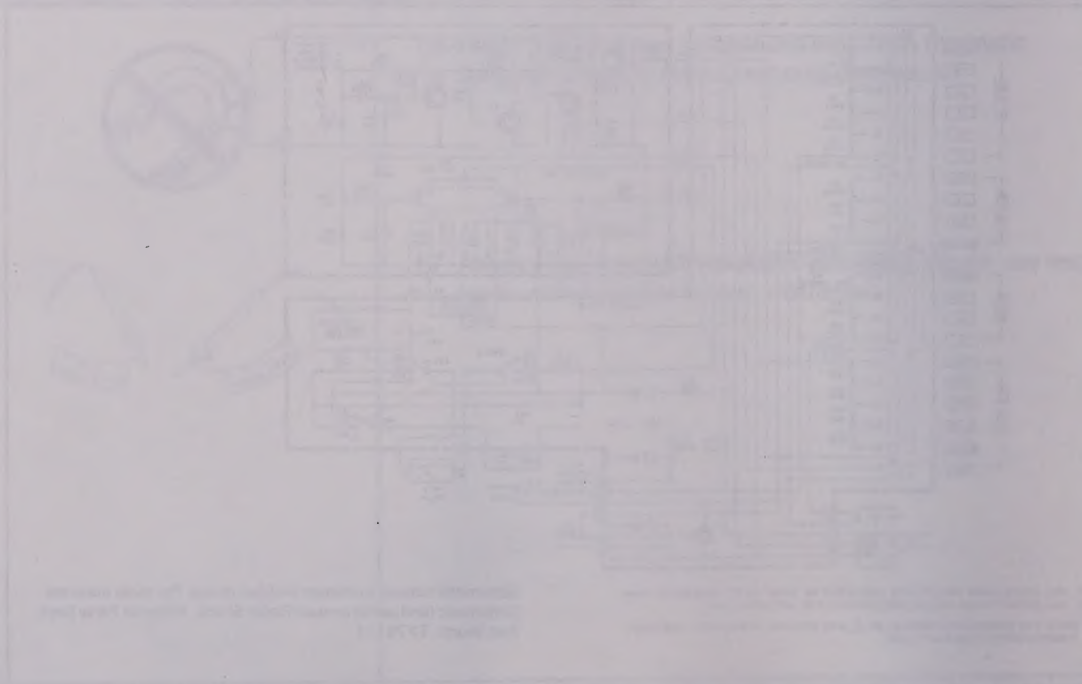


NOTES: (1) ALL RESISTANCE VALUES ARE INDICATED IN "OHM" (K=10^3 OHM, M=10^6 OHM).
(2) ALL CAPACITANCE VALUES ARE INDICATED IN "μF" (P=10^{-6} μF).

CAUTION: SINCE THE COMPONENTS MARKED BY ⚠ ARE CRITICAL FOR SAFETY, USE ONLY THOSE DESCRIBED ON PARTS LIST.

Schematic subject to change without notice. For most accurate Schematic (and parts) contact Radio Shack, National Parts Dept., Fort Worth. TX76101

NOTE:



NOTE:

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 90 days from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

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